Installation Instructions

(220V Single-phase Input using ABB ACS550 VFD)

TABLE OF CONTENTS

Parts List ……..…….. Page 3

Fan Placement, Spacing, and Clearance ……..…… Page 4

Fan Maintenance ……..…. Page 4

Installation Instructions ……..…….. Page 5

Control Keypad Instructions …… Page 16

Daisy Chaining …….. Page 20

MECHANICAL ITEMS INCLUDED IN YOUR SHIPMENT

5 Fan Blades
5 Fan Blade Flaps
5 Fan Blade End Caps
1 Fan Drive Assembly
1 Beam Mounting Bracket
3 ¼" Turnbuckles with jam nuts
Gearbox Vent (Must be installed)
Bolts, nuts, washers, and clamps of various sizes (see Installation Instructions for types and quantities)

ELECTRICAL ITEMS INCLUDED IN YOUR SHIPMENT

1 Lockable disconnect with installation instructions

- 1 ABB ACS550 Variable Frequency Drive (VFD) with remote keypad
    a. One (1) VFD mounting bracket and hardware kit
    b. 100 ft. of Cat 6 cable (with RJ45 connectors)
    c. Three (3) wire crimps for motor control cable
    d. One (1) Cat 6 cable strain relief
    e. One (1) Remote control keypad box
    f. One (1) ACS550 drive User's Manual
    g. One (1) motor control cable (fan motor to VFD)
    h. Two (2) motor cable strain reliefs

FAN SAFETY COMPONENTS PROVIDED

Drive Assembly safety cable (1)
Guy wires (3)
Blade Safety Brackets (5)

TOOLS TO GET STARTED

Scissor lift
Wrench and socket set (5/16"-3/4" needed)
Cordless power driver with clutch and Phillips Bit
1/4" Nut driver
Torque wrench
Standard and Phillips screwdrivers
Instrument screwdriver (1/8" flat blade)
Wire stripper/cutter
Level
3/16" "L" shaped Allen wrench
Three (3) beam clamps with eye bolts

Check that all necessary parts are included with your shipment. Should an item be missing, contact Patterson immediately at (800) 768-3985.

Note: In order to protect personnel, equipment, and the fan, it is important that all safety components are installed per these instructions. Failure to properly install any or all of these safeguards may void the manufacturer's warranty. **Electrical installation should be performed by a licensed electrician.**

FAN SPACING, PLACEMENT, AND CLEARANCE

Fans should be mounted such that the blades are a minimum of 10 feet above the floor. The ideal height is 20 to 25 feet. Also, ensure that the fan blades have a clearance equal to **15% of the fan's diameter in all directions**.

Care should be taken when installing the fan around a fire sprinkler system. The VFD is equipped with the ability to connect to a fire suppression system – stopping the fans in case of a fire. However, it is the responsibility of the installer to read and comply with all local codes and regulations.

MAINTENANCE

Prior to performing any maintenance on the fan, it **MUST** be disconnected from the power source by means of the separate lockable disconnect provided.

VFD Box – Clean heat dissipating fins on the back of the box periodically.

Gearbox – Periodic maintenance will ensure your fan remains operational for its intended life. While Patterson recommends the end-user check and change the gearbox oil annually, failure to do so will not void any warranties. Oil type used is Chevron® Delo Gear ESI 85W-140. Contact Patterson at (800) 768-3985 for availability.

Hub Grease – Hub should be inspected yearly to ensure proper lubrication. Grease type is Chevron Delo HD Moly 5%. There are two grease fittings, an upper and lower. Add grease as needed, filling each area slowly until grease passes through the upper seal.

Mounting Hardware – All nuts and bolts related to mounting of the fan unit should be checked for tightness annually. In addition, guy wires need to be inspected to ensure they remain taut and show no signs of fraying.

Blades – Blades can be occasionally wiped down with a damp cloth. A mild detergent can also be used if desired.

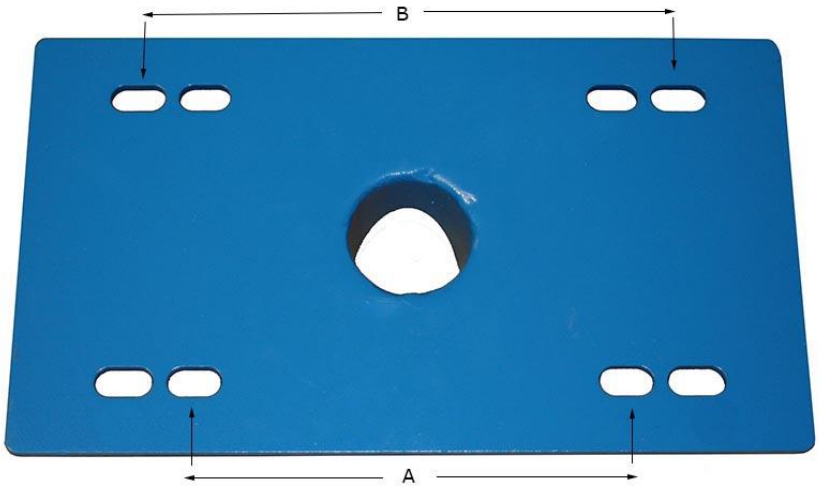
INSTALLATION PROCEDURES

Step 1: Attach Mounting Bracket and VFD Bracket to Structure

A) It is important to attach the mounting bracket to the structure **first** and **then** connect the fan assembly.

B) Refer to Image 1 to determine which set of bolt slots to use:

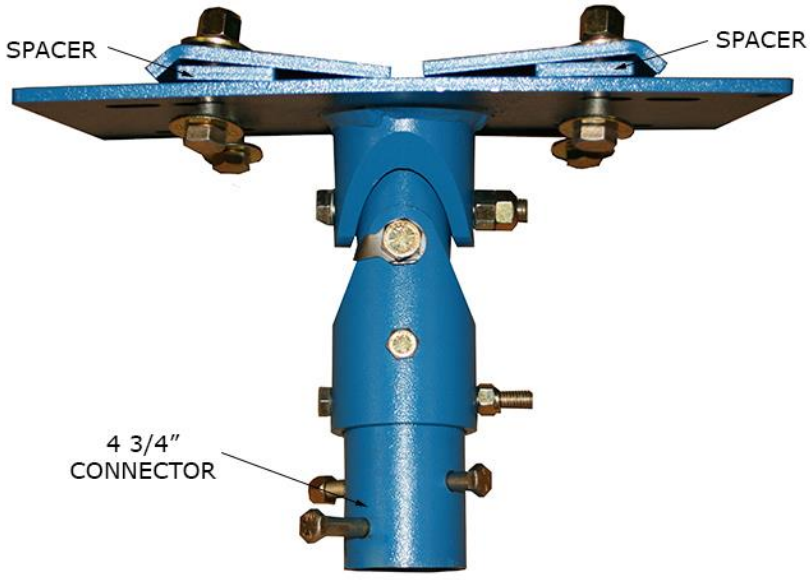
Image 1



i) For I-beam width less than 7¼", use slots labeled "A". I-beams wider than 7¼" should use slots labeled "B".

ii) For I-beam thickness greater than ½", use the provided spacer as shown in Image 2.

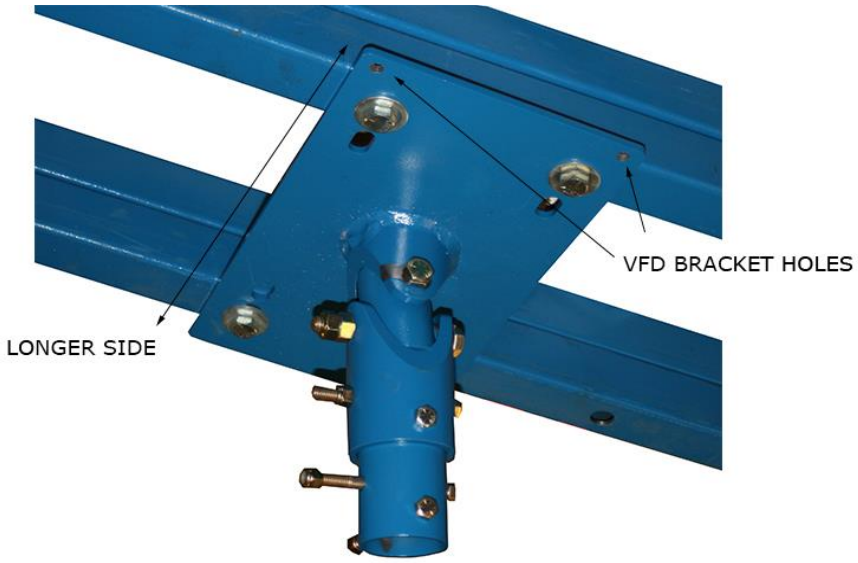
Image 2



iii) Attach clamp to structure, torqueing GRADE 8 ½" bolts to 80 ft-lbs.

iv) **(OPTIONAL)** When attaching the mounting bracket to added "bridges" between two or more points of an existing structure (i.e. bar joists, Z-purlins, etc.), orient the beam plate as shown in Image 3. This will ensure guy wire cables are properly aligned with the structure. <u>In this configuration, the beam clamps will **NOT** be necessary. Also, longer GRADE 8 ½" bolts are needed (not provided).</u>

Image 3



v) Using the hardware provided, attach the VFD to the VFD bracket. Then attach the VFD/bracket combination to the mounting plate by means of the two (2) pre-drilled holes (see Image 3). A properly installed VFD is shown in Image 4.

Image 4

<u>INSTALLER Please Note</u>: Customers may request that the VFD NOT be mounted on the fan so that it can be accessed. It is important to emphasize that after installation, there is no reason to get to the drive. ALL of the information, resets, error codes and parameters are accessed from the remote keypad only. If the customer insists, Belden 29522C Multi-Conductor 600V VFD cable should be used. Failure to use proper VFD cable may result in operational issues with the drive or fan and can shorten life expectancy.

vi) If a down rod was ordered, remove the 4¾" connector and replace with the longer down rod. Refer to Image 2.

<u>Step 2</u>: Attach Fan Assembly to Mounting Hardware

A) Using a scissor lift, raise the fan assembly and guide the connector (or down rod) into the tube on top of the fan frame until its mounting holes line up (see Image 5).

Image 5

Image 6

B) Secure the fan to the swivel assembly (or end of down rod) as shown in Image 6. Torque bolts to 35 ft-lbs.

Step 3: Install Fan Assembly Safety Cable

Note: This step is required. Failure to install the safety cable may void the manufacturer's warranty.

A) Pass one end of the safety cable underneath where the three vertical frame members join together (at the top of the fan drive assembly).

B) The opposite end of the safety cable should be passed over the top of the I-beam or other mounting structure. Connect the two ends of the cable together by means of 3 saddle clamps (provided) in the manner shown in Image 7.

C) Tighten the saddle clamps securely using a ½" socket. Torque to 15 ft-lbs

Image 7

Step 4: Connect Both Ends of the Motor Control Cable

Reference: Pages 16-32 of the ACS550 User's Manual

A) Remove the cover of the VFD using the steps shown on page 17 of the *"ACS550 User's Manual"* under the heading *"IP 54 / UL Type 12"*.

B) Remove the cable seals located on the bottom of the drive as needed. A total of three cable seals must be removed to accommodate the motor cable, power cable, and Cat 6 cable.

C) Pass the cable conductors and shielding through one of the provided strain reliefs, and then through one of the holes on the bottom of the VFD.

D) Connect one end of the motor control cable to the VFD in the manner shown on page 29 of the *"ACS550 User's Manual."* The three conductors should be connected to U2, V2, and W2, respectively, using the three (3) yellow wire crimps. The cable foil shield should be secured by the cable clamp as shown in Image 8.

E) Connect the opposite end of the motor control cable to the fan motor. This will require removal of one of the knockouts on the motor's junction box. As before, pass the cable conductors and shielding through the strain relief, and then through the junction box hole. **The wiring configuration is input voltage dependent. Please wire the motor properly using the wiring diagrams found on the fan motor's nameplate.**

F) Once cable is properly connected at both ends, tighten down the strain reliefs.

Step 5: Run Input Power to Drive and Install Lockable Disconnect

References: Pages 16-32 of the ACS550 User's Manual
Lockable Disconnect Installation Instructions

WARNING: The Lockable Disconnect must be installed per local electrical codes. AT MINIMUM it must be installed outside the diameter of the fan blades.

A) Run input power into the top of the Lockable Disconnect, using the appropriately sized knockout.

B) Connect conductors to terminals L1and L2, respectively. Ground wire should be fastened to the protective earth (PE).

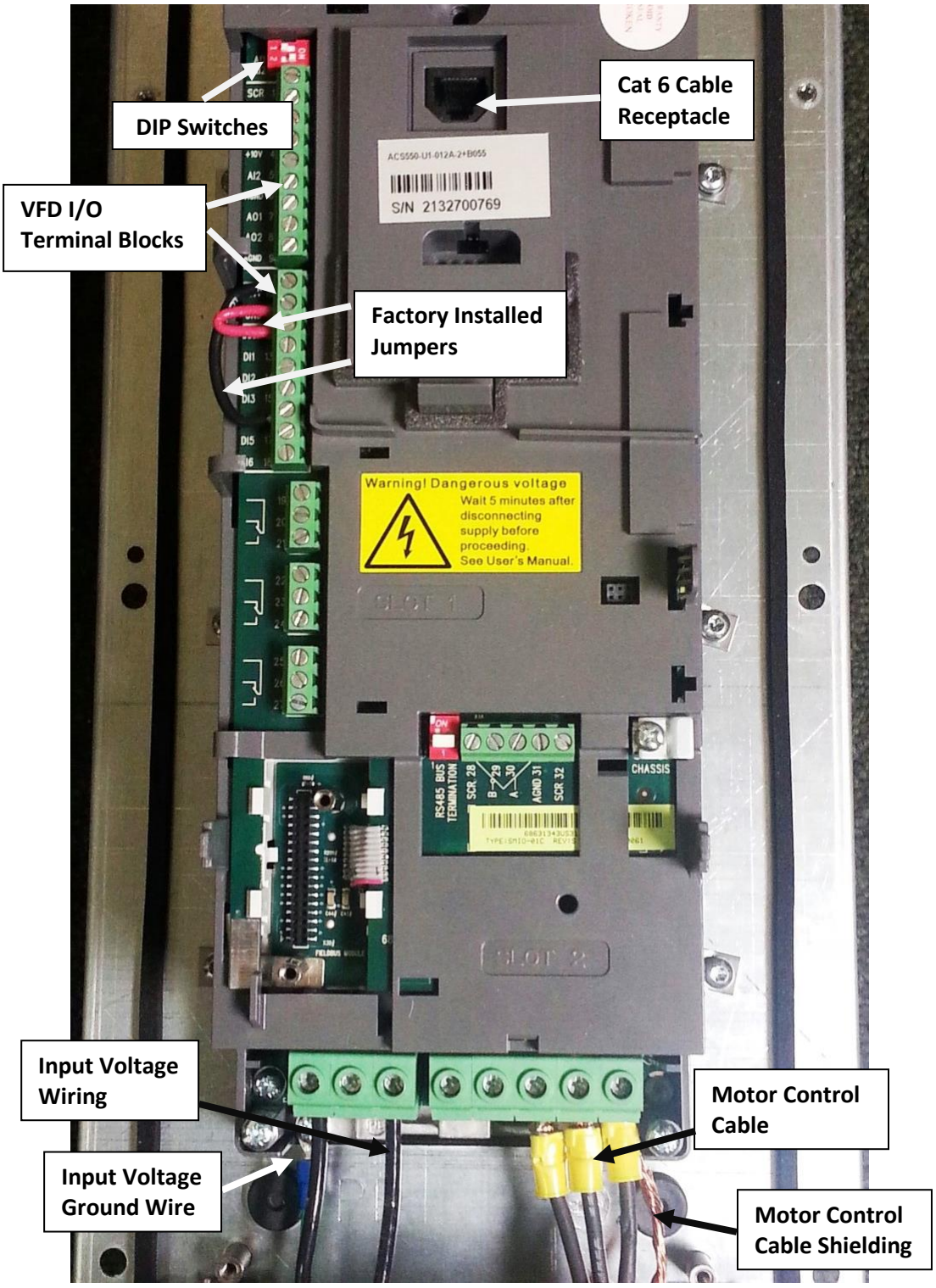
C) On the output side, T2 should be looped back to input L3.

D) Continue running input power to the drive by connecting two conductors to terminals T1 and T3, respectively. A ground wire should be fastened to the protective earth (PE) provided.

E) Connect the opposite end of the input power cable to the VFD in the manner shown on page 29 of the *"ACS550 User's Manual."* The two conductors should be connected to U1 and W1, respectively. The ground wire should be connected in the manner shown in Image 8.

F) A successfully wired drive should appear like Image 8.

Image 8



Step 6: Install Guy Wires

Note: For maximum stability, the angle formed between the guy wire and the ceiling should be **less** than 45 degrees.

This step is required. Failure to install the guy wires properly may void the manufacturer's warranty AND become a safety hazard.

The following steps should be performed with the aid of a scissor lift.

Image 9

A) Attach the looped end of the guy wire to the turnbuckle located on the fan assembly. It should appear like the Image 10.

Image 10

B) Pass the opposite end of the guy wire through the eye bolt of a beam clamp (not supplied). **Thimbles must be used to protect the cable from damage.**

C) Reduce the slack in each cable, making sure the fan assembly remains in the vertical position. Use 3 saddle clamps to crimp the end of the guy wire together as shown in Image 11. Ensure saddle clamps are positioned so that the teeth on the nut side grab the end of the cable that is most likely to slip.

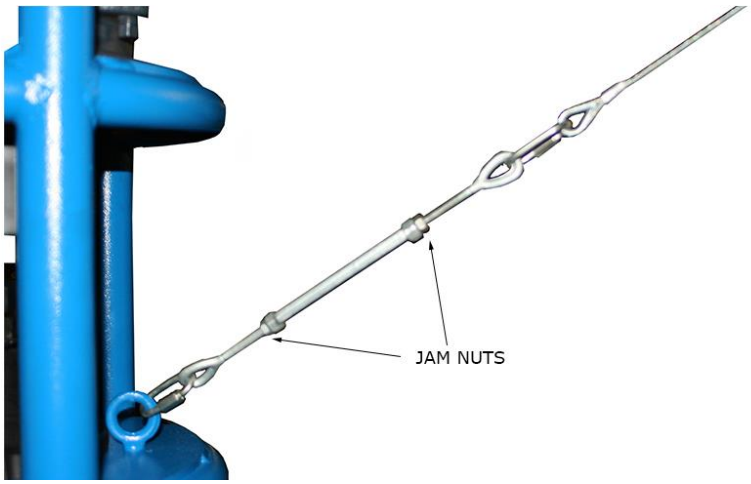
Image 11

D) Repeat steps A – C for the remaining two guy wires.

E) Once all guy wires are in place, use the turnbuckles to take out any remaining slack. Periodically check the fan assembly with a level to ensure it remains in the vertical position. Continue adjusting by means of the turnbuckles until all cables are satisfactory. Guy wires should be taut, but not over stressed. Recheck all saddle clamps for tightness.

F) **Tighten all jam nuts on turn buckles (Image 12). This step is required. Failure to install the guy wires properly may void the manufacturer's warranty AND become a safety hazard.**

Image 12



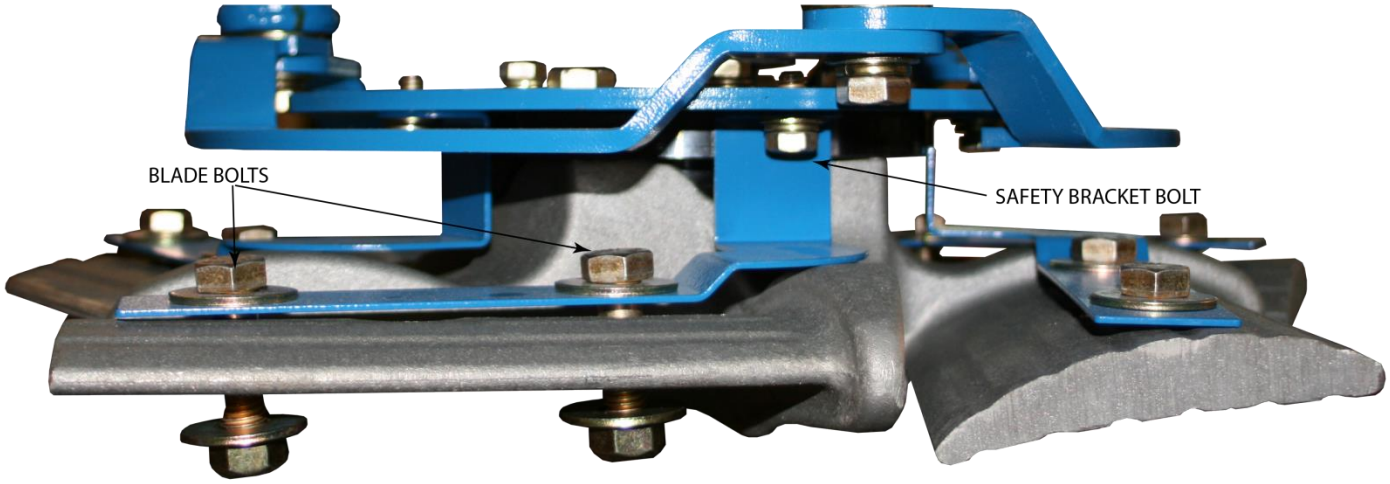
<u>Step 7</u>: Install Fan Blades & Secure Blade Safety Bracket

A) Care should be taken when installing the blades to ensure they are not bent or damaged, as this may affect fan performance.

B) Remove blade bolts, nuts, and washers from blade “paddle” on the fan’s hub. Loosen Safety Bracket bolt (shown in Image 13) until the bracket moves freely. Carefully slide the fan blade into position until all blade bolt holes on the fan, blade, and safety bracket are aligned. Replace blade bolts, nuts, and washers. Torque to 65 ft-lbs.

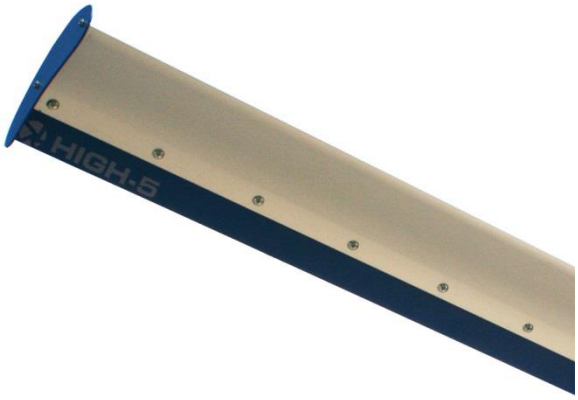
C) Tighten the 3/8” Safety Bracket bolt on the other end of the blade safety bracket.

Image 13



D) Install blade flaps using ¼” bolts and end caps using #10 x ½” screws provided. Ensure ¼” bolts are tight on flaps. The pan head of the bolts go into the countersinks in the bottom of the blades. Refer to Image 14 for more information.

Image 14



E) Repeat steps B – D for the remaining 4 blades.

Step 8: Remove Plug in Cap of Gearbox

Note: This step is required. Failure to remove the plug may cause gearbox seals to leak due to pressurization of the lubrication fluid, possibly voiding the manufacturer's warranty.

A) Remove plug in the gearbox and replace with vent prior to operation of the fan. **The vent fitting is in a bag that is affixed to the frame at the location of the plug.**

Step 9: Mount the Remote Keypad Enclosure and Connect to VFD

Note: It is vitally important that the remote keypad is ALWAYS mounted outside the blade radius of the fan. This is especially important for the daisy chaining configuration (see page 20). The daisy chaining process requires access to the keypad while the fan is in motion.

A) Once a desired location is found, affix the remote keypad to the wall using the mounting pads attached to the keypad enclosure.

B) Run the Cat 6 cable up to the fan-mounted VFD via the shortest possible path. If possible, avoid lighting and other noise-producing electrical equipment. Running the cable inside conduit is optional.

C) Pass the Cat 6 cable through the strain relief and then into the bottom of the drive. Connect the cable to the appropriate receptacle on the face of the VFD (see Image 8 on page 10). Be sure to tighten the strain relief on the bottom of the VFD.

D) Replace the cover of the VFD using the steps show on page 32 of the *"ACS550 User's Manual,"* under the heading *"IP 54 / UL Type 12".*

Step 10: Connect the VFD to the Fire Suppression System (OPTIONAL)

Please Note: If the drive will not be connected to any fire suppression system, the factory installed jumper across 10 & 16 MUST remain in place.

A) Remove the factory installed jumper between terminals 10 and 16. The terminal block is located at the left side of the ACS550. For more information, refer to Image 8 on page 10.

B) Connect the fire suppression system wires to terminals 10 and 16. Again, the fire system cable will enter the drive enclosure through the bottom (additional cable seal must be removed).

C) Drive is now wired to shut down upon activation of any fire suppression signal.

This completes the installation of your High-5 Fan.

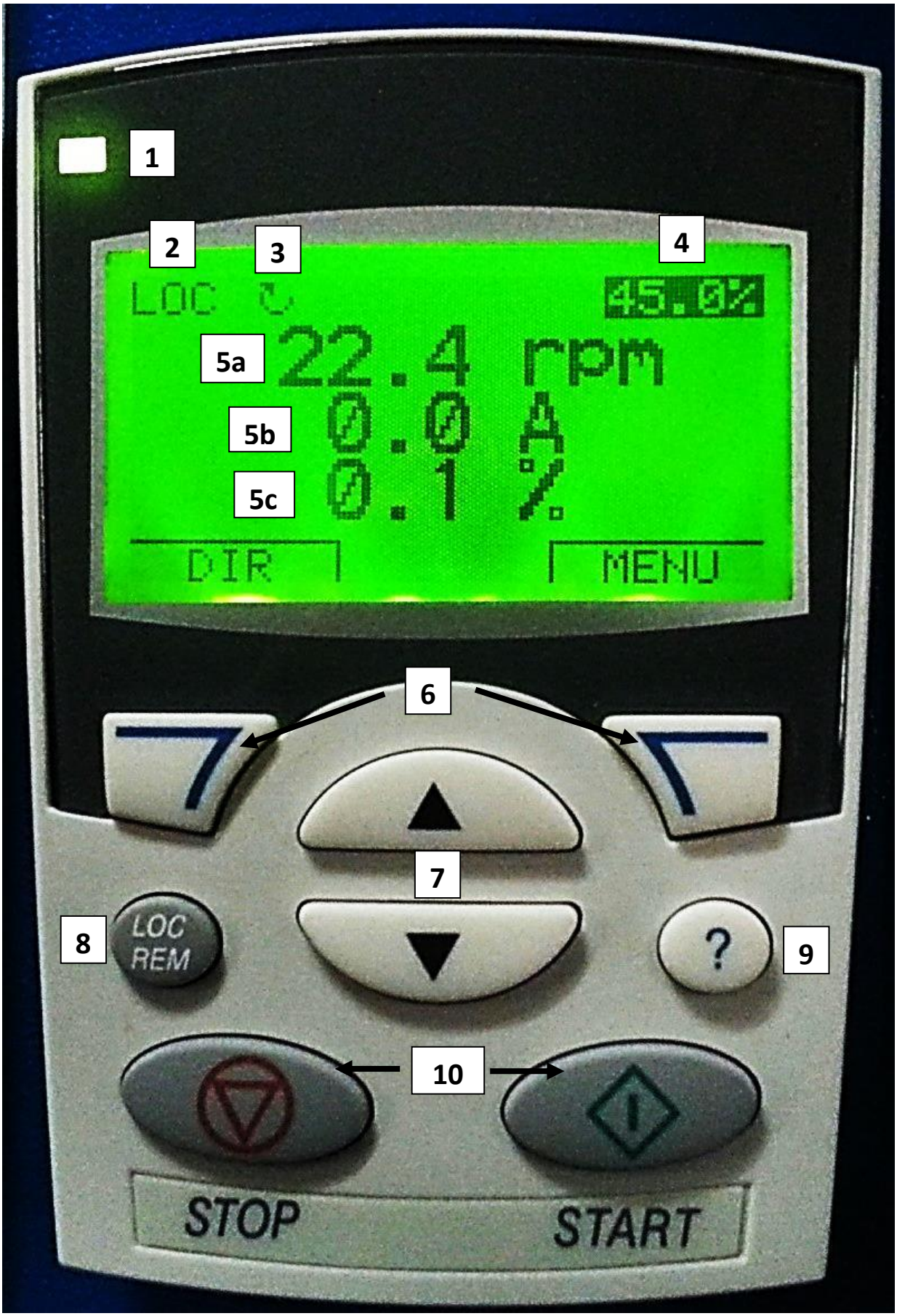
HIGH-5

Fan Control
Keypad Instructions

<u>CAUTION</u>: Please read carefully and completely before fan operation.

FAN ROTATION: Proper rotation is achieved when the directional indicator (#3 in Image 15) is clockwise and the blade flaps are trailing. If rotation is not correct, swapping two of the motor wires (L1, L2 or L3) in the motor junction box will change the rotation.

IMAGE 15


1
2
3
4
LOC
45.0%
5a
22.4 rpm
5b
0.0 A
5c
0.1 %
DIR
MENU
6
7
8
LOC
REM
?
9
10
STOP
START

CONTROL KEYPAD FEATURES

1. **Status LED:**
    a. Green – Normal Operation
    b. Blinking Green – Fan drive is in alarm. Consult the drive's User Manual for alarm conditions.
    c. Red – Fan drive has faulted. Consult the drive's User Manual for fault conditions.

2. **LOC/REM Indicator:** Indicates whether the drive is in local or remote control. See LOC/REM button entry below for more detail.

3. **Rotation Indicator:** Indicates rotation of the fan motor shaft (and fan blades). See item #2 in the section entitled *Additional Information.*

4. **Fan Speed Set Point:** Indicates fan speed as a percent of maximum (%). This percentage corresponds to a read-only RPM reading (see #5 below). Can be adjusted using the up and down arrows (see #7 below).

5. **Read-Only Parameters:** Give real-time readouts of the following conditions:
    a. Fan speed – Expressed in RPM (see #4 above)
    b. Fan motor amperage – Indicates the current being drawn by the fan motor, expressed in Amperes (A)
    c. Fan motor torque – Indicates fan motor output torque, expressed in percentage (%)

6. **Soft Keys:** Located directly below functions displayed in the lower corners of the keypad screen. Right Soft Key is generally not used during basic fan operation. Left Soft Key controls fan direction. See section entitled *Additional Information*.

7. **Up/Down Arrows:** Allow for adjustment of the Fan Speed Set Point (either while the fan is stopped or in motion). See section entitled *Fan Operation*.

8. **LOC/REM Button:** Toggles between local and remote control of the fan drive. If LOC is displayed in the upper left corner of the keypad screen, control of the drive is initiated locally (i.e. from the keypad). If REM is displayed, control is initiated from an external source (i.e. another drive or fieldbus).

9. **Help Button:** Provides more information during drive programming. Not used for fan operation.

10. **Start/Stop Buttons:** Used to start and stop the fan. See section entitled *Fan Operation*.

FAN OPERATION

Starting the Fan:

1. Make sure the LOC/REM Indicator shows the fan drive is in local (LOC) mode. The fan **will not** respond to inputs from the keypad if the drive is in remote (REM) mode. Use the LOC/REM Button as needed to ensure local control.

2. Using the Up/Down Arrow keys, adjust the Fan Speed Set Point. Remember, the Fan Speed Set Point is based on **percentage of maximum speed.** **This percentage corresponds to the read-only RPM indicator.**

3. Press the **START** button, and allow the fan to ramp up to speed. This may take a few seconds. To prevent damage to the gearbox, it is recommended that the fan reach its Set Point speed before making any further adjustments.

4. If the initial Set Point adjustment is unsatisfactory, refer to the section below entitled *"Adjusting Fan Speed While in Motion"* to achieve the desired fan RPM.

Adjusting Fan Speed While in Motion:

1. Ensure local (LOC) control of the drive (see above).

2. Use the Up/Down Arrow keys to adjust the Fan Speed Set Point as desired. **For best results**, use the Read-Only Fan Speed indicator (in RPMs) as a gauge for your desired setting. The fan will then ramp up or down in response to the changing input.

3. **Caution: DO NOT adjust the Fan Speed up and down repeatedly in large increments. Allow the fan to reach the new speed before making any further adjustments.**

Stopping the Fan:

1. Ensure local (LOC) control of the drive (see above).

2. Press the **STOP** button. The fan will then ramp down to a complete stop. This may take a few seconds. **Allow the fan to stop COMPLETELY before restarting.**

ADDITIONAL INFORMATION

1. Fan drives are programmed prior to shipment. In order to ensure continuity, drive parameters are locked by means of a three-digit passcode. Should troubleshooting of the drive become necessary, contact Patterson at (800) 768-3985. A passcode can then be given to unlock the drive's parameters. It is highly recommended that the parameters be relocked (using the same passcode) prior to putting the fan back in service.

2. Patterson's High-5 fans are designed to maximize air movement while spinning in the FORWARD direction. However, they can be run in REVERSE. Follow these steps:
    a. If the fan is stopped, press the left Soft Key with the letters "DIR" above it. When the fan is started, it will run in the reverse direction.
    b. If the fan is running, press the **STOP** button, and allow the fan to come to a **complete** stop. Then press the left Soft Key with the letters "DIR" above it. When the fan is started, it will run in the reverse direction.

3. Please be aware that each fan is programmed to have a minimum fan speed, set at some level above 0%. This is to protect the fan motor. The minimum speed will vary depending on the size of the fan.

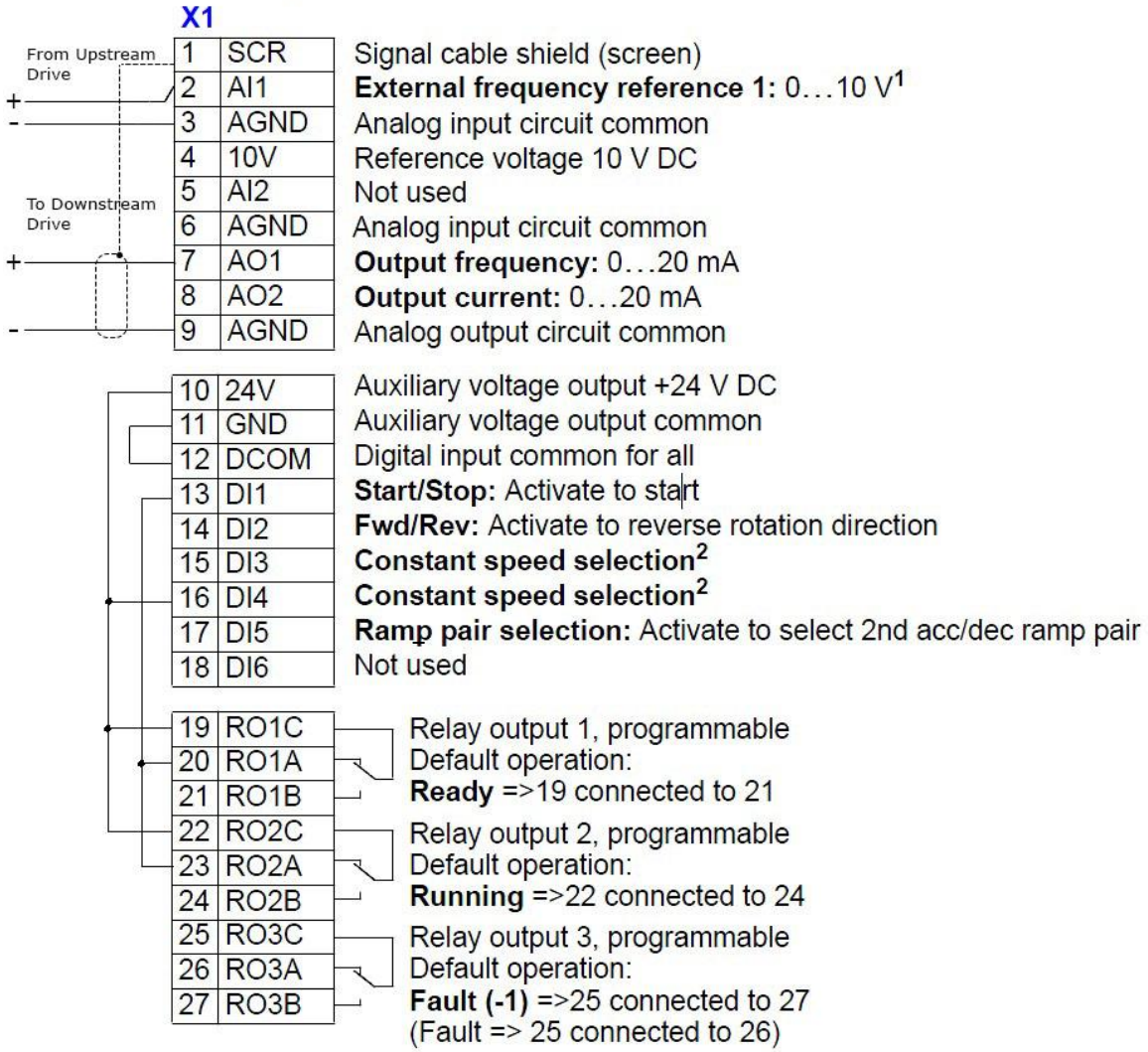
Daisy Chaining

Daisy chaining is a set up by which the output of one VFD is tied to the input of the next VFD downstream. This allows for a master/follower configuration. The "master" fan remains in LOCAL mode, while all the "followers" are set to REMOTE. The followers will then rotate at the same speed as the master fan.

Note: Any fan in the daisy chain can be set to LOCAL (LOC) mode for local control. **However, all of the fans downstream will then begin to rotate at the speed of that fan, NOT the designated master.**

Each follower must be wired according to the diagram on page 21. The VFD designated as the master will be wired in exactly the same manner, but **without wiring ANYTHING into terminals 2 and 3 on the VFD.**

Connection example:



Key Points for Daisy Chaining:

1. Wire for daisy chaining must be: 2-conductor with ground, **18 AWG**, double shielded.

2. Based on the wiring diagram, please note that only the “to downstream drive” end of the daisy chain wire shield is connected to the drive at terminal 1. The shield on the input side (terminals 2 and 3) is **not** connected.

3. Please note the series of jumpers in the above diagram. These must be connected in addition to the daisy chain input/output wiring. Two of the jumpers are already factory installed (see below). The rest must be connected at the time of fan installation. The numbers in the diagram correspond to numbers on the drive’s terminal block (see Image 8 on page 10 of these instructions).
   Factory installed jumpers – 11 & 12 / 10 & 16
   Field installed jumpers – 10 & 19 / 10 & 22 / 13 & 20 / 13 & 23

4. Make sure that the DIP switch labeled “1” is in the ON (or right) position. This switch is located above I/O terminal block pin #1. Refer to Image 8 on page 10 for more information.

5. To reduce noise and potential drive interruption, it is recommended that daisy chain wire be run through conduit.

6. **Speed scaling:** Because of line losses, downstream followers may initially rotate at a slower speed than that of the master. To rectify this problem, perform these steps:

   Make sure the “master” fan is in LOCAL mode and all “followers” are in REMOTE mode. If it is safe to do so, turn the master fan on to maximum speed. All fans should begin spinning at this time. Note the maximum speed on the master unit’s keypad (in RPMs).

   a. Go to the first downstream follower. If the unit is rotating at the same speed as the master, no additional action is necessary. However, if the speed is slower than the master, go to Step (b).

   b. Unlock the follower’s parameter set.
      i. Set the fan in local mode by pressing the LOC/REM button.
      ii. Press the MENU key on the keypad.
      iii. Highlight the PARAMETERS option. Press ENTER.
      iv. Use the up/down arrow keys to highlight parameter group 16. Press SELECT.
      v. Scroll down to parameter 1603 PASS CODE. Enter the pass code shown next to the parameter’s description on page 125 of the *“ACS550 User’s Manual.”* You will use the up/down arrow keys to enter the code. Once entered, press the SAVE key.
      vi. Scroll up and select parameter 1602 PARAMETER LOCK. Using the arrow keys, change the status from LOCKED to OPEN. Press the SAVE key.
      vii. Continue pressing the EXIT key until you arrive at the keypad’s output screen. Return the fan to REMOTE mode by pressing the LOC/REM button.
      viii. Go to Step (c).

   c. Once the parameter set has been unlocked, the fan speed will need to be scaled to match that of the master. To accomplish this:
      i. Press the MENU key on the keypad.
      ii. Highlight the PARAMETERS option. Press ENTER.
      iii. Use the up/down arrow keys to highlight parameter group 01. Press SELECT.
      iv. Scroll down to parameter 0120 AI 1. This is a read-only parameter. Jot down or remember its value, expressed as a percentage (%). Press EXIT until you reach the keypad output screen.
      v. Place the fan in LOCAL control by pressing the LOC/REM button.
      vi. Navigate back to parameter group 13. Press SELECT.
      vii. Find parameter 1302 MAXIMUM AI1. Using the arrow keys, enter the percentage from parameter 0120. Press the SAVE key.

viii. Press EXIT until you reach the keypad output screen. Return the fan to REMOTE mode. The fan should immediately start to speed up to match the master.

d. Repeat Steps (b) – (c) for each additional downstream follower. It is advisable to re-lock each fan's parameter set after adjusting the speed scale, reversing the instructions in Step (b). This will prevent unnecessary tampering with fan drive parameters.

e. Once all followers have been properly scaled, return to the master fan and set the desired speed for the daisy-chained system.

For additional questions concerning the daisy chain configuration, contact Patterson engineering at (800) 768-3985.

This completes the High-5 Keypad Instructions.